

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
28 October 2004 (28.10.2004)

PCT

(10) International Publication Number  
**WO 2004/092530 A3**

(51) International Patent Classification<sup>7</sup>: **E21B 7/20**

(21) International Application Number:  
PCT/US2004/011177

(22) International Filing Date: 13 April 2004 (13.04.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data: 60/462,750 14 April 2003 (14.04.2003) US

(71) Applicant (for all designated States except US): **ENVENTURE GLOBAL TECHNOLOGY** [US/US]; 16200 A. Park Row, Houston, TX 77084 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **COOK, Robert, Lance** [US/US]; 934 Caswell Court, Katy, TX 77450 (US). **SMOLEN, Randall, Mercer** [US/US]; 3027 Kenross, Houston, TX 77043 (US). **KENT, Gerald, Edward** [CA/CA]; #10 - 26120, TWP. 511, Devon, Alberta T7Y

1B8 (CA). **HAY, Richard, Thomas** [CA/CA]; 5 Lodgepole Court, St. Albert, Alberta T8N 2R8 (CA). **KEEN, Jerry, Lavelle, Jr.** [US/US]; 3630 Rolling Terrace, Spring, TX 77388 (US).

(74) Agent: **MATTINGLY, Todd**; Haynes and Boone, L.L.P. Suite 3100, 901 Main Street, Dallas, TX 75202 (US).

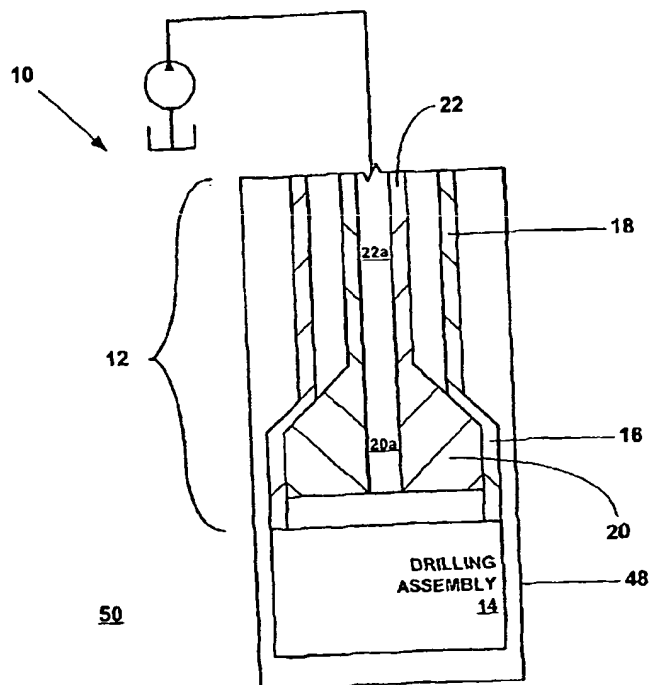
(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR,

[Continued on next page]

(54) Title: **RADIALLY EXPANDING CASING AND DRILLING A WELLBORE**

(57) Abstract: A method of radially expanding a wellbore casing (18) and drilling a wellbore (48).



WO 2004/092530 A3

BEST AVAILABLE COPY



GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK,  
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,  
ML, MR, NE, SN, TD, TG).

— with amended claims

(88) Date of publication of the international search report:  
21 April 2005

**Declaration under Rule 4.17:**

— of inventorship (Rule 4.17(iv)) for US only

Date of publication of the amended claims: 11 August 2005

**Published:**

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

**AMENDED CLAIMS**

[received by the International Bureau on 13 April 2005 (13.04.05);  
original claims 1-22 are replaced by amended claims 1-24; claim]

1. An apparatus for radially expanding a tubular member and drilling a wellbore within a subterranean formation, comprising:
  - an expandable tubular member;
  - an expansion device coupled to the expandable tubular member adapted to radially expand and plastically deform the expandable tubular member within the wellbore comprising:
    - a tubular expansion mandrel; and
    - a tubular expansion mandrel launcher for housing the tubular expansion mandrel coupled to the expandable tubular member;
  - a pump coupled to the expansion device adapted to pump fluidic materials through the tubular expansion mandrel into a portion of the tubular expansion mandrel launcher;
  - a drilling device coupled to the expansion device adapted to receive the fluidic materials pumped into the portion of the tubular expansion mandrel launcher and drill the wellbore within the subterranean formation comprising:
    - one or more flow control elements for controlling the flow of the received fluidic materials;
    - a motor coupled to the flow control elements adapted to be operated by the fluidic materials; and
    - a drill coupled to the motor adapted to be driven by the motor; and
  - a controller coupled to the expansion device and the drilling device that is programmed to control the expansion device and the drilling device to operate in one of the following modes of operation: (a) drilling the wellbore using the drilling device or expanding the tubular member using the expansion device; or (b) drilling the wellbore using the drilling device and expanding the tubular member using the expansion device simultaneously.
2. The apparatus of claim 1, wherein the operational characteristics of the flow control elements vary as a function of the operational characteristics of the pumped fluidic materials.
3. The apparatus of claim 2, wherein the operational characteristics of the flow control elements comprise a resistance to flow of the fluidic materials.

4. The apparatus of claim 2, wherein the operational characteristics of the pumped fluidic materials comprise a frequency dependent component.
5. (Canceled)
6. A method of radially expanding a wellbore casing within a wellbore and drilling the wellbore through a subterranean formation, comprising:  
positioning an expandable casing, an expansion device for radially expanding the expandable casing, and a drilling device for extending the wellbore within the wellbore; and  
operating the expansion device and the drilling device using a method comprising:  
selecting drilling or expanding or drilling and expanding;  
if drilling or expanding is selected, then sequentially performing the following in any order:  
extending the wellbore using the drilling device; and  
expanding the casing using the expansion device; and  
if drilling and expanding is selected, then simultaneously performing the following:  
extending the wellbore using the drilling device; and  
expanding the casing using the expansion device;  
wherein the expansion device comprises an expansion mandrel.
7. A method of radially expanding a wellbore casing within a wellbore and drilling the wellbore through a subterranean formation, comprising:  
positioning an expandable casing, an expansion device for radially expanding the expandable casing, and a drilling device for extending the wellbore within the wellbore; and  
operating the expansion device and the drilling device using a method comprising:  
selecting drilling or expanding or drilling and expanding;  
if drilling or expanding is selected, then sequentially performing the following in any order:  
extending the wellbore using the drilling device; and  
expanding the casing using the expansion device; and  
if drilling and expanding is selected, then simultaneously performing the following:  
extending the wellbore using the drilling device; and  
expanding the casing using the expansion device;

wherein the expansion device comprises a rotating expansion device.

8. A method of radially expanding a wellbore casing within a wellbore and drilling the wellbore through a subterranean formation, comprising:
- positioning an expandable casing, an expansion device for radially expanding the expandable casing, and a drilling device for extending the wellbore within the wellbore; and
  - operating the expansion device and the drilling device using a method comprising:
    - selecting drilling or expanding or drilling and expanding;
    - if drilling or expanding is selected, then sequentially performing the following in any order:
      - extending the wellbore using the drilling device; and
      - expanding the casing using the expansion device; and
    - if drilling and expanding is selected, then simultaneously performing the following:
      - extending the wellbore using the drilling device; and
      - expanding the casing using the expansion device; and
  - varying the operational characteristics of at least one of the drilling device and the expansion device as a function of the operational characteristics of pumped fluidic materials.
9. The method of claim 8, wherein the operational characteristics of at least one of the drilling device and the expansion device comprise a resistance to flow of the fluidic materials.
10. The method of claim 8, wherein the operational characteristics of at least one of the drilling device and the expansion device comprise a frequency dependent component.
11. (Canceled)
12. A system for radially expanding a wellbore casing within a wellbore and drilling the wellbore through a subterranean formation, comprising:
- means for positioning an expandable casing, an expansion device for radially expanding the expandable casing, and a drilling device for extending the wellbore within the wellbore; and
  - means for operating the expansion device and the drilling device comprising:
    - means for selecting drilling or expanding or drilling and expanding;

if drilling or expanding is selected, then means for sequentially performing the following in any order:

extending the wellbore using the drilling device; and

expanding the casing using the expansion device; and

if drilling and expanding is selected, then means for simultaneously performing the following:

extending the wellbore using the drilling device; and

expanding the casing using the expansion device; and

means for varying the operational characteristics of at least one of the drilling device and the expansion device as a function of the operational characteristics of the pumped fluidic materials.

13. The system of claim 12, wherein the operational characteristics of at least one of the drilling device and the expansion device comprise a resistance to flow of the fluidic materials.

14. The system of claim 12, wherein the operational characteristics of at least one of the drilling device and the expansion device comprise a frequency dependent component.

15. An apparatus for radially expanding a tubular member and drilling a wellbore within a subterranean formation, comprising:

an expandable tubular member;

an expansion device coupled to the expandable tubular member adapted to radially expand and plastically deform the expandable tubular member within the wellbore;

a drilling device coupled to the expansion device adapted to drill the wellbore within the subterranean formation; and

a controller coupled to the expansion device and the drilling device that is programmed to control the expansion device and the drilling device to operate in one of the following modes of operation: (a) drilling the wellbore using the drilling device or expanding the tubular member using the expansion device; or (b) drilling the wellbore using the drilling device and expanding the tubular member using the expansion device simultaneously.

16. The apparatus of claim 15, wherein the expansion device comprises an expansion mandrel.

17. The apparatus of claim 15, wherein the expansion device comprises a rotating expansion device.
18. The apparatus of claim 15, wherein the controller comprises one or more flow control elements whose operational characteristics are frequency dependent.
19. An apparatus for radially expanding a tubular member and drilling a wellbore within a subterranean formation, comprising:  
an expandable tubular member;  
an expansion device coupled to the expandable tubular member adapted to radially expand and plastically deform the expandable tubular member within the wellbore comprising:  
a tubular expansion mandrel; and  
a tubular expansion mandrel launcher for housing the tubular expansion mandrel coupled to the expandable tubular member;  
a pump coupled to the expansion device adapted to pump fluidic materials through the tubular expansion mandrel into a portion of the tubular expansion mandrel launcher;  
a drilling device coupled to the expansion device adapted to receive the fluidic materials pumped into the portion of the tubular expansion mandrel launcher and drill the wellbore within the subterranean formation comprising:  
one or more flow control elements for controlling the flow of the received fluidic materials;  
a motor coupled to the flow control elements adapted to be operated by the fluidic materials; and  
a drill coupled to the motor adapted to be driven by the motor; and  
a controller coupled to the expansion device and the drilling device that is programmed to control the expansion device and the drilling device to operate in one of the following modes of operation: (a) drilling the wellbore using the drilling device or expanding the tubular member using the expansion device; or (b) drilling the wellbore using the drilling device and expanding the tubular member using the expansion device simultaneously;  
wherein the operational characteristics of the flow control elements vary as a function of the operational characteristics of the pumped fluidic materials;  
wherein the operational characteristics of the flow control elements comprise a resistance to flow of the fluidic materials; and  
wherein the operational characteristics of the pumped fluidic materials comprise a

frequency component.

20. A method of radially expanding a wellbore casing within a wellbore and drilling the wellbore through a subterranean formation, comprising:
- positioning an expandable casing, an expansion device for radially expanding the expandable casing, and a drilling device for extending the wellbore within the wellbore; and
  - operating the expansion device and the drilling device using a method comprising:
    - selecting drilling or expanding or drilling and expanding;
    - if drilling or expanding is selected, then sequentially performing the following in any order:
      - extending the wellbore using the drilling device; and
      - expanding the casing using the expansion device;
    - if drilling and expanding is selected, then simultaneously performing the following:
      - extending the wellbore using the drilling device; and
      - expanding the casing using the expansion device; and
    - varying the operational characteristics of at least one of the drilling device and the expansion device as a function of the operational characteristics of pumped fluidic materials;
- wherein the operational characteristics of at least one of the drilling device and the expansion device comprise a resistance to flow of the fluidic materials; and wherein the operational characteristics of at least one of the drilling device and the expansion device comprise a frequency dependent component.
21. A system for radially expanding a wellbore casing within a wellbore and drilling the wellbore through a subterranean formation, comprising:
- means for positioning an expandable casing, an expansion device for radially expanding the expandable casing, and a drilling device for extending the wellbore within the wellbore;
  - means for operating the expansion device and the drilling device comprising:
    - means for selecting drilling or expanding or drilling and expanding;
    - if drilling or expanding is selected, then means for sequentially performing the following in any order:
      - extending the wellbore using the drilling device; and
      - expanding the casing using the expansion device; and
    - if drilling and expanding is selected, then means for simultaneously



performing the following:  
extending the wellbore using the drilling device; and  
expanding the casing using the expansion device; and  
means for varying the operational characteristics of at least one of the drilling device  
and the expansion device as a function of the operational characteristics of  
pumped fluidic materials;  
wherein the operational characteristics of at least one of the drilling device and the  
expansion device comprise a resistance to flow of the fluidic materials; and  
wherein the operational characteristics of at least one of the drilling device and the  
expansion device comprise a frequency dependent component.

22. An apparatus for radially expanding a tubular member and drilling a wellbore within a  
subterranean formation, comprising:  
an expandable tubular member;  
an expansion device coupled to the expandable tubular member adapted to radially  
expand and plastically deform the expandable tubular member within the  
wellbore;  
a drilling device coupled to the expansion device adapted to drill the wellbore within  
the subterranean formation; and  
a controller coupled to the expansion device and the drilling device that is  
programmed to control the expansion device and the drilling device to operate  
in one of the following modes of operation: (a) drilling the wellbore using the  
drilling device or expanding the tubular member using the expansion device;  
or (b) drilling the wellbore using the drilling device and expanding the tubular  
member using the expansion device simultaneously;  
wherein the controller comprises one or more flow control elements whose  
operational characteristics are frequency dependent.

23. A method of radially expanding a wellbore casing within a wellbore and drilling the  
wellbore through a subterranean formation, comprising:  
positioning an expandable casing, an expansion device for radially expanding the  
expandable casing, and a drilling device for extending the wellbore within the  
wellbore; and  
operating the expansion device and the drilling device using a method comprising:  
selecting drilling or expanding or drilling and expanding;  
if drilling or expanding is selected, then sequentially performing the following  
in any order:

extending the wellbore using the drilling device; and  
 expanding the casing using the expansion device; and  
 if drilling and expanding is selected, then simultaneously performing the  
 following :

extending the wellbore using the drilling device; and  
 expanding the casing using the expansion device;

wherein the casing is expanded in a direction toward a top of the casing.

24. A system for radially expanding a wellbore casing within a wellbore and drilling the wellbore through a subterranean formation, comprising:

means for positioning an expandable casing, an expansion device for radially expanding the expandable casing, and a drilling device for extending the wellbore within the wellbore; and

means for operating the expansion device and the drilling device using a method comprising:

means for selecting drilling or expanding or drilling and expanding;

if drilling or expanding is selected, then means for sequentially performing the following in any order:

extending the wellbore using the drilling device; and

expanding the casing using the expansion device; and

if drilling and expanding is selected, then means for simultaneously performing the following:

extending the wellbore using the drilling device; and

expanding the casing using the expansion device;

wherein the casing is expanded in a direction toward a top of the casing.

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

☐ BLACK BORDERS

☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES

☐ FADED TEXT OR DRAWING

☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING

☒ SKEWED/SLANTED IMAGES

☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS

☐ GRAY SCALE DOCUMENTS

☐ LINES OR MARKS ON ORIGINAL DOCUMENT

☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY

☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**